

NEW SPECIES AND HOST RECORDS OF APHID PARASITOIDS
(HYMENOPTERA: BRACONIDAE: APHIDIINAE) FROM THE
PACIFIC NORTHWEST, U.S.A.

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Abstract.—The aphidiine parasitoids (Hymenoptera: Braconidae: Aphidiinae) of the Pacific Northwest, U.S.A., were surveyed. Findings are based principally on field collections from Washington, but a few records from nearby states are included. Twelve genera and more than 40 species are recorded. The material was obtained from pest and nonpest aphid rearings sampled from a range of farmland and neighboring environments. Complete records are provided on the parasitoid species, associated aphid and plant hosts. Four new species of aphidiine parasitoids are described and illustrated: *Binodoxys clydesmithi* Pike and Starý, n. sp. (hosts: *Zyxaphis* sp. and *Obtusicauda coweni* Hunter on sagebrush, *Artemisia tridentata*), *Binodoxys graft* Pike and Starý, n. sp. (hosts: *Aphis helianthi* Monell, *Aphis* nr. *varians* Patch, and *Aphis* sp. on *Epi-lobium angustifolium*), *Pauesia pseudotsugae* Pike and Starý, n. sp. (host: *Cinara pseudotaxifoliae* Palmer on *Pseudotsuga menziesii*), and *Trioxys rosae* Pike and Starý, n. sp. (host: *Macrosiphum rosae* (L.) on *Rosa* sp.). Also, *Trioxys cirsii* (Curtis), a European species, was detected for the first time in North America (host: *Drepanosiphum platanoides* (Schrank) on *Acer pseudoplatanus*).

Key Words: Parasitoids, new species, *Binodoxys*, *Pauesia*, *Trioxys*, aphids

Research on aphidiine parasitoids (Hymenoptera, Braconidae, Aphidiinae) began in Washington in 1989 in association with studies on the biological control of Russian wheat aphid, *Diuraphis noxia* (Kurdjumov). Discovery of new species of parasitoids attacking grain aphids (Pike and Starý 1995b) demonstrated a lack of knowledge concerning the aphid parasitoid species richness and activity within the region, and prompted expanded environmental studies to explore and define the diversity and host

range of the aphid parasitoids across a range of farmlands and neighboring ecosystems. The success or extent of parasitoid activity on pest aphids is linked in part to their alternate hosts. The present work represents the first comprehensive review of the known aphidiine parasitoids (Hymenoptera: Braconidae: Aphidiinae) of the Pacific Northwest, U.S.A. region, and provides a basis for further work on such topics as species richness, abundance, spatial and temporal distributions, host-habitat preference,

nature conservation, and ecological optimizations for parasitoid enhancement. The work also provides a basis for comparison of indigenous fauna with new or future introductions.

The review is based on extensive field survey and collections made over 6 years (1989–94). Collections were taken mainly from Washington, but some were taken from nearby states. New descriptions are given for four new species of aphidiine parasitoids reared from aphids on Douglas fir (*Pseudotsuga menziesii*), fireweed (*Epilobium angustifolium*), rose (*Rosa* sp.), and sagebrush (*Artemisia tridentata*).

For cross reference and other information on aphid parasitoids of North America, see Liu 1977, Marsh 1979, and Johnson 1987; for world information, see Mackauer and Starý 1967.

MATERIAL AND METHODS

A search for aphid parasitoids was undertaken by sampling aphids in the field from wild and cultivated plants across a wide range of habitats, i.e. annual and perennial crops, grass and sage rangelands, roadsides, wetlands, wildlife reserves, parks, backyards, gardens, and forest lands. A total of 668 samples was taken during the collection years. Collected aphids were held in semi-transparent plastic containers (300 ml, 10 cm dia × 4 cm ht) on clipped foliage at ambient laboratory temperatures ranging from 17 to 23°C for 30 days to allow for parasitoid development and emergence. Aphidiine parasitoids generally emerged within the first 10 days.

Descriptions of new taxa were based on whole dry and dissected slide-mounted material examined under the microscope at 40 to 600×. Body lengths were measured and recorded in millimeters. Holotypes were dry-mounted on paper tabs and pinned. The descriptive terminology used is after Huber and Sharkey (1993). Holotypes are deposited in the National Museum of Natural History, Smithsonian Institution, Washington, DC (USNM).

RESULTS

Aphidiine Parasitoid Genera and Species

Parasitoid genera and species are listed alphabetically, as are aphid hosts under each species. References, if any, are listed at the end of each record of aphid host, location, and date of collection. All aphids and parasitoids were collected by the authors unless otherwise indicated. Numbers in parentheses represent authors' codes of specimens (aphid-parasitoids) in Washington State University (WSU)-Prosser collections.

Genus *Adialytus* Förster

A. ambiguus (Haliday)

Sipha elegans del Guercio: MT, Sanders Co., Plains, 26-VII-94, on *Agropyron intermedium* (94R036).

Sipha sp.: WA, Asotin Co., near Anatone, 23-IX-93, on Gramineae (93T022).

A. fuscicornis (Ashmead)

Aphid undetermined: WA, Asotin Co., 8-VII-93, on *Populus trichocarpa* (93T001).

A. salicaphis (Fitch)

Chaitophorus populicola Thomas: ID, Boundary Co., near Bonners Ferry, 26-VIII-94, on *Populus trichocarpa* (94R026).

Chaitophorus utahensis (Knowlton): WA, Yakima Co., Grandview, 3-VI-94, on *Salix* sp. (94-052).

Chaitophorus sp.: WA, Asotin Co., 8-VII-93, on *Salix* sp. (93T002, 93T003). WA, Benton Co., County Line Rd, 20-X-94, on *Salix* sp. (94G088).

Periphyllus sp.: WA, Asotin Co., near Anatone, 25-VIII-93, on *Acer* sp. (93T017).

Genus *Aphidius* Nees

A. avenaphis (Fitch)

Sitobion avenae (F.): WA, Klickitat Co., Bickleton, 16-VI-93, 23-VII-93, on

Hordeum vulgare var. Steptoe (93K002, 93K003), and on *Tritico-secale rimpani* (93K001).

A. colemani Viereck

Undetermined aphid: WA, King Co., Seattle, Volunteer Park, V-94, on *Hibiscus* sp. (94T001).

A. ervi Haliday

Acyrtosiphon pisum (Harris): MT, Sanders Co., Plains, 26-VII-94, on *Lathyrus odoratus* (94R034). WA, Benton Co., WSU-Prosser, 17 & 25-V-94, 29-VII-94, on *Medicago sativa* (94-004, 94-010, 94-014, 94-032, 94-037, 94R051), and 17-V-94, on *Trifolium pratense* (94-007).

Brevicoryne brassicae (L.): WA, Benton Co., WSU-Prosser, 1-XI-94, on *Brassica napus* (94G096).

Diuraphis noxia (Kurdjumov): WA, Asotin Co., near Anatone, 5-VIII-93, on *Avena fatua* (93T024). WA, Benton Co., WSU-Prosser, 17-V-94, 2-VI-94, on *Hordeum vulgare* (94-011, 94-050), and 23-IV-91, 27-V-94, 13 & 28-VI-94, on *Triticum aestivum* (91A004, 91A006, 91A008, 94-045, 94-145, 94A008). WA, Yakima Co., Grandview, 29-V-94, on *Triticum aestivum* (94-047).

Rhopalosiphum padi (L.): WA, Benton Co., WSU-Prosser, 17-IV-92, on *Triticum aestivum* (92A006).

Sitobion avenae (F.): WA, Asotin Co., near Anatone, 12-VII-94, on *Triticum aestivum* (94T023). WA, Benton Co., WSU-Prosser, 27-V-94 on *Hordeum vulgare* (94-043), and 27-V-94, 27-VI-94 on *Triticum aestivum* (94-045, 94K098). WA, Whitman Co., near Pullman, 19-VII-93 on *Triticum aestivum* (93T012).

Mixed aphids on cereals: *Diuraphis noxia* (Kurdjumov), *Rhopalosiphum padi* (L.), *Sitobion avenae* (F), WA, Klickitat Co., near Bickleton, 23-VI-93 on *Hordeum vulgare*

(93K004), on *Triticum aestivum* (93K005), and 2-VIII-93 on *Tritosecale rimpani* (93K008).

Undetermined aphid: WA, Asotin Co., near Anatone, 5-VIII-93 on *Lactuca serriola* (93T004).

A. hortensis Marshall

Liosomaphis berberidis (Kaltenbach): OR, Multnomah Co., Multnomah Falls, 9-10-94, on *Berberis* sp. (94-135). WA, Yakima Co., Yakima Arboretum, 3-VI-94, on *Berberis* sp. (94-056).

A. kakimiaphidis Smith

Kakimia aquilegiae (Essig): WA, Kittitas Co., Lost Lake, 7-VII-94, on *Aquilegia formosa* (94K036).

Kakimia cynosbati (Oestlund): WA, Kittitas Co., Lost Lake, 7-VII-94, on *Aquilegia formosa* (94K026).

Kakimia sp.: MT, Sanders Co., W. Fork Thompson River, 26-VII-94, on *Castilleja* sp. (94R030). WA, Yakima Co., White Pass, 22-VII-94, on *Mimulus lewisii* (94R020).

A. lupini Liu

Macrosiphum albifrons Essig: WA, Yakima Co., Bird Lake near Mt. Adams, 8-IX-94, on *Lupinus* sp. (94R163, 94R186).

A. matricariae Haliday

Brachycaudus helichrysi (Kaltenbach): WA, King Co., Redmond, 5-XI-92, on *Senecio* sp. (92L001).

Phorodon humuli (Schrank): WA, Benton Co., WSU-Prosser, 13 & 28-IX-94, on *Humulus lupulus* (94R202, 94R250).

A. ohioensis Smith

Macrosiphoniella ludoviciana (Oestlund): CA, Shasta Co., near Cayton, Northshore CG, 23-VI-94, on *Artemisia ludoviciana* (94K012).

Uroleucon ivae Robinson: WA, Benton Co., WSU-Prosser, 21-VII-94, on *Iva xanthifolia* (94R012). WA, Yakima Co., Sunnyside, 13-VII-94 (94G009), and Grandview, 29-VII-94 (94R055), on *Iva xanthifolia*.

Uroleucon sp.: WA, Yakima Co., Grandview, 23-VIII-94, on *Iva xanthifolia* (94R122).

A. *polygonaphis* Fitch

Macrosiphum euphorbiae (Thomas): WA, Kittitas Co., Lost Lake, 7-VII-94, on *Rosa* sp. (94K045).

A. *smithi* Sharma & Subba Rao

Acyrtosiphon pisum (Harris): WA, Benton Co., WSU-Prosser, 25-VIII-94, on *Medicago sativa* (94R126).

A. spp.

Acyrtosiphon pisum (Harris): WA, Benton Co., WSU-Prosser, 25-VIII-94, on *Medicago sativa* (94R126). WA, Kittitas Co., Lost Lake, 7-VII-94, on *Rhododendron albiflorum* (94K031).

Aphis armoraciae Cowen: WA, Kittitas Co., Lost Lake, 7-VII-94, on *Mertensia paniculata* (94K030).

Aphis varians Patch: WA, Pierce Co., Mt Rainier National Park, White River CG, 18-VIII-94, on *Epilobium angustifolium* (94R118).

Aphis sp.: ID, Latah Co., Moscow, 15-IX-93, on *Solanum lycopersicon* (93T020).

Diuraphis noxia (Kurdjumov): WA, Benton Co., WSU-Prosser, 13-VI-94, on *Triticum aestivum* (94-145).

Eoessigia longicauda (Richards): WA, Skamania Co., South Prairie, on *Spiraea douglasii* (94R192).

Hyperomyzus sp.: WA, Benton Co., WSU-Prosser, 11-VI-94, on *Sonchus oleraceus* (94-144).

Illinoia rhododendri (Wilson): WA, Kittitas Co., Lost Lake, 7-VII-94, on *Rhododendron albiflorum* (94K043).

Illinoia sp.: WA, Skamania Co., Goose

Lake, 8-VI-94, on *Vaccinium* sp. (94-126).

Kakimia sp.: MT, Sanders Co., W. Fork Thompson River, 26-VII-94, *Castilleja* sp. (94R030).

Macrosiphum californicum (Clarke): WA, Kittitas Co., 7-VII-94, on *Salix* sp. (94K048).

Metopolophium dirhodum (Walker): WA, Kittitas Co., Lost Lake, 7-VII-94, on *Rhododendron albiflorum* (94K027).

Myzus sp.: WA, Whitman Co., Pullman, 14-IX-93, on *Forsythia* sp. (93T019).

Sitobion avenae (F.): WA, Asotin Co., Field Springs State Park, 5-VIII-93, on Gramineae (93T013). WA, Columbia Co., near Dayton, 16-VI-94, on *Triticum aestivum* (94T020). WA, Whitman Co., near Pullman, 5-VII-94, on *Triticum aestivum* (94T022).

Uroleucon ivae Robinson: WA, Benton Co., near Grandview, County Line Rd & I-82, 11-VIII-94, 07-IX-94, on *Iva xanthifolia* (94R094, 94R142).

Utamphorophora humboldti (Essig): OR, Multnomah Co., Multnomah Falls, 8-IV-92, on *Physocarpus* sp. (92A002).

Mixed aphids: *Chaetosiphon tetrahodum* (Walker), *Fimbriaphis wakibae* (Hottes) and *Macrosiphum euphorbiae* (Thomas), WA, Kittitas Co., Lost Lake, 7-VII-94, on *Rosa* sp. (94K045). *Hyperomyzus lactucae* (L.) and *Uroleucon sonchi* (L.), WA, Benton Co., WSU-Prosser, 21-V-94, on *Sonchus oleraceus* (94-020).

Undetermined aphids: WA, Asotin Co., near Asotin, 9-VII-93, on *Chrysothamnus nauseosus* (93T025). WA, Kittitas Co., Lost Lake, 7-VII-94, on *Lonicera involucrata* (94K028), and near Manashtash Lake, 29-VI-93, on *Rhododendron albiflorum* (94G004).

Genus *Binodoxys* Mackauer

B. *carolinensis* (Smith)

Aphis varians Patch: MT, Sanders Co., W. Fork Thompson River, 26-VII-

94, on *Epilobium angustifolium* (94R029).

***B. clydesmithi* Pike & Starý, new species**
(Figs. 1–8)

Diagnosis.—Following a key by Smith (1944), the new species keys to *B. coruscigrans* (Gahan). The latter was originally described by Gahan (1911), and later re-described by Smith (1944) based on large series of specimens reared from *Obtusicauda coweni* Hunter (from Idaho and Utah) and *O. jonesi* (Gillette & Palmer) (from Utah). We have examined a female specimen from Smith's (1944) collection reared from *O. coweni* (Smithfield Canyon, Utah); it agrees both with the description by Gahan (1911) and the redescription by Smith. The distinguishing features of *B. coruscigrans* are: number and arrangement of setae on prong (Fig. 9), i.e. 4–5 setae, similar in length, and situated on basal two-thirds of prong; seta at prong apex stout, lanceolate, horizontal; ovipositor sheath almost claw-shaped (Fig. 10); spiracular and secondary tubercles of equal size, distinctly separated on metasomal tergum 1; coloration of metasoma yellow on distal fourth, especially lateral and lower portions; ovipositor sheath and prong piceous. *B. clydesmithi* differs from *B. coruscigrans* in that the prongs are comparatively more stout, bear more dorsal setae, and with only a simple seta at apex; ovipositor sheath not claw-shaped; spiracular and secondary tubercles closely spaced on metasomal tergum 1; and coloration of metasoma, ovipositor sheath and prong dark brown. Both species are associated with sagebrush aphids and probably, or at least partially overlap in their distribution in the Pacific Northwest.

Eymology.—The new species is named in honor of Clyde F. Smith who has contributed substantially to the research on Nearctic Aphidiinae parasitoids.

Description.—*Female*. Head. Tentoriocular line $\frac{3}{4}$ malar space, slightly longer than $\frac{1}{6}$ eye length, shorter than $\frac{1}{3}$ intertentorial

line. Antenna 11-segmented, reaching to end of metasomal tergum 2, width increasing towards apex. Flagellomere 1 (=F₁) (Fig. 2) length 3.5× width, setae about half segmental width, without longitudinal placodes. F₂ (Fig. 3) length equal to width, subequal to length of F₁. F₅ (Fig. 5) length slightly >2× width, about $\frac{1}{3}$ wider than F₁. F₈ (Fig. 6) length slightly >2× width, wider than F₅.

Mesosoma. Mesonotal setae relatively sparse, effacing notauli on disc. Propodeum (Fig. 4) smooth, setae sparse, indications of divergent carinae in lower portion.

Forewing (Fig. 1). Stigma length 3× greatest width; distal abscissa of R1 (=metacarpus) equal to about $\frac{2}{3}$ stigma length; lower marginal setae 4× longer than surface setae.

Legs. Hind femur with adpressed setae $\frac{1}{3}$ segmental width.

Metasoma. Metasomal tergum 1 (Fig. 8) 1.5× as long as width at spiracles; spiracular tubercles poorly prominent in comparison with secondary tubercles; distance between spiracular and secondary tubercles $\frac{1}{6}$ width between spiracles.

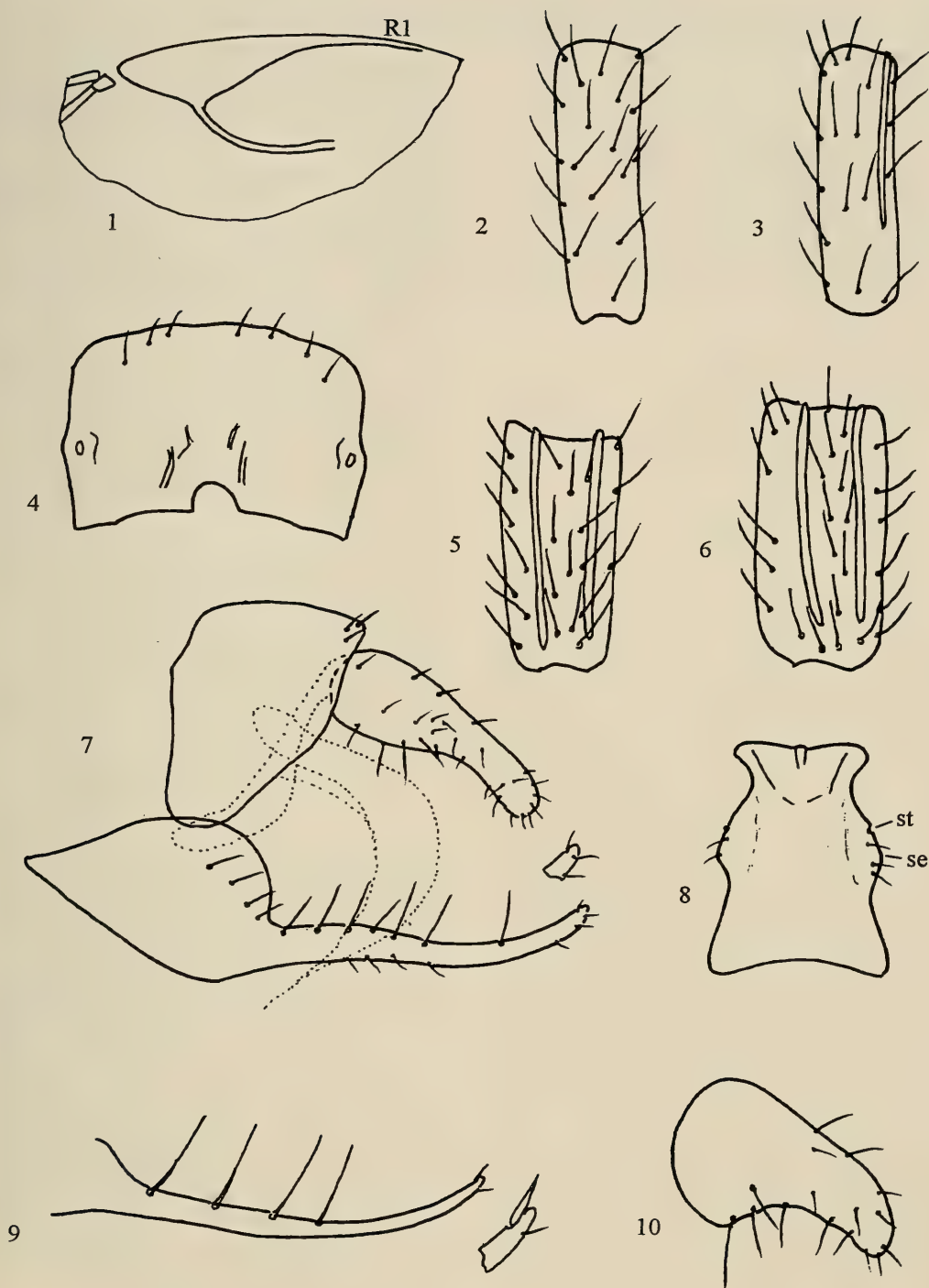
Genitalia (Fig. 7). Prong with 7 long setae on dorsal margin, a few shorter setae on ventral margin, and two simple oblique setae at apex.

Coloration. Head dark brown, mouthparts yellowish. Antennal scape, pedicel, F₁ and F₂ yellow, remaining segments brown. Mesosoma dark brown. Wings subhyaline, venation light brown. Middle and hind legs brown to dark brown; trochanter, trochantellus and base of tibia lighter. Metasoma dark brown; apex of tergum 1 and center of terga 2–3 yellow brown; ovipositor sheath and prong dark brown.

Length of body about 1.6 mm.

Male. Antenna 13-segmented, brown, pedicel yellowish; otherwise coloration similar to female.

Holotype [♀].—USA, WA, Kittitas Co., Lost Lake, 7-VII-1994, coll. K. Pike & G. Graf. Host: *Obtusicauda coweni* Hunter and



Figs. 1-10. 1-8, *Binodoxys clydesmithi*, ♀ paratypes (illustrations not to equal scale). 1, Forewing, in part. 2, Flagellomere 1. 3, Flagellomere 2. 4, Propodeum. 5, Flagellomere 5. 6, Flagellomere 8. 7, Genitalia. 8, Metasomal tergum 1. Abbreviations: R1, postmarginal vein; Se, secondary tubercle; St, spiracular (= primary) tubercle. 9-10, *B. coruscanigrans*, ♀ (illustrations not to equal scale). 9, Prong. 10, Ovipositor sheath.

Zyzaphis oregonensis Wilson on *Artemisia tridentata*, sample no. 94K042. Deposited in USNM.

Paratypes.—1 ♀, 2 ♂♂ (pinned), same data as holotype. Deposited in the Washington State University Collection, James Museum, Pullman, Washington; additional material deposited in the Washington State University Collection-Prosser, WA, and the collection of P. Starý, České Budějovicé, Czech Republic.

***B. conei* Pike & Starý**

Phorodon humuli (Schrank): WA, Benton Co., WSU-Prosser, 7-IX-94, on *Humulus lupulus* (94W004) [see Pike & Starý 1995a].

***B. grafi* Pike & Starý, new species**
(Figs. 11–13).

Diagnosis.—The new species has a number of features (areolated propodeum, nearly unicolorous metasoma, 11-segmented antenna, metacarpus/pterostigma length/width ratio) in common with *B. carolinensis* (Smith) (1944) and *B. nearctaphidis* Mackauer (1965), but differs markedly in the shape of metasomal tergum 1. With *B. carolinensis*, primary (= spiracular) and secondary tubercles are equally sized, but with *B. grafi* primary tubercle separation is $\frac{1}{4}$ to $\frac{1}{3}$ less than secondary tubercles. With *B. nearctaphidis*, primary and secondary tubercle separation is less than $\frac{1}{2}$ width across spiracles, prong straight with one basally dilated perpendicular seta close to a simple apical seta (for description and illustration, see Mackauer 1956); with *B. grafi* primary and secondary tubercle separation is about $\frac{3}{4}$ width across spiracles, prong slightly arcuate with two simple oblique apical setae.

Etymology.—The name of the species is in honor of George Graf, Washington State University Research Technician who participated in the first collection of the new species.

Description.—*Female*. Head. Antenna 11-segmented, reaching to slightly beyond metasomal tergum 1, width increasing to-

wards apex. Flagellomere 1 (=F₁) length 3× width, with 1 longitudinal placode. F₂ equal to F₁ in size, with 3 longitudinal placodes. F₅ slightly more than twice as long as wide. F₈ length 2× width, slightly wider than F₅, $\frac{1}{3}$ wider than F₁.

Mesosoma. Mesonotum with notauli crenulate in ascendent portion, effaced on disc as indicated by a row of sparse setae. Propodeum with distinct complete pentagonal areola.

Forewing (Fig. 11). Stigma length 3× width, distal abscissa of R₁, $\frac{1}{3}$ shorter than stigma; Rs slightly longer than stigma, and 3× stigma width; lower marginal setae three times as long as surface setae.

Legs. Hind femur with short adpressed setae.

Metasoma. Tergum 1 (Fig. 12) length about 2.5× width at spiracles, with coarse longitudinal rugosities in middle third; secondary tubercles prominent, about $\frac{1}{4}$ to $\frac{1}{3}$ wider than across primary (= spiracular) tubercles; distance between primary and secondary tubercles about $\frac{1}{4}$ less than width across primary tubercles.

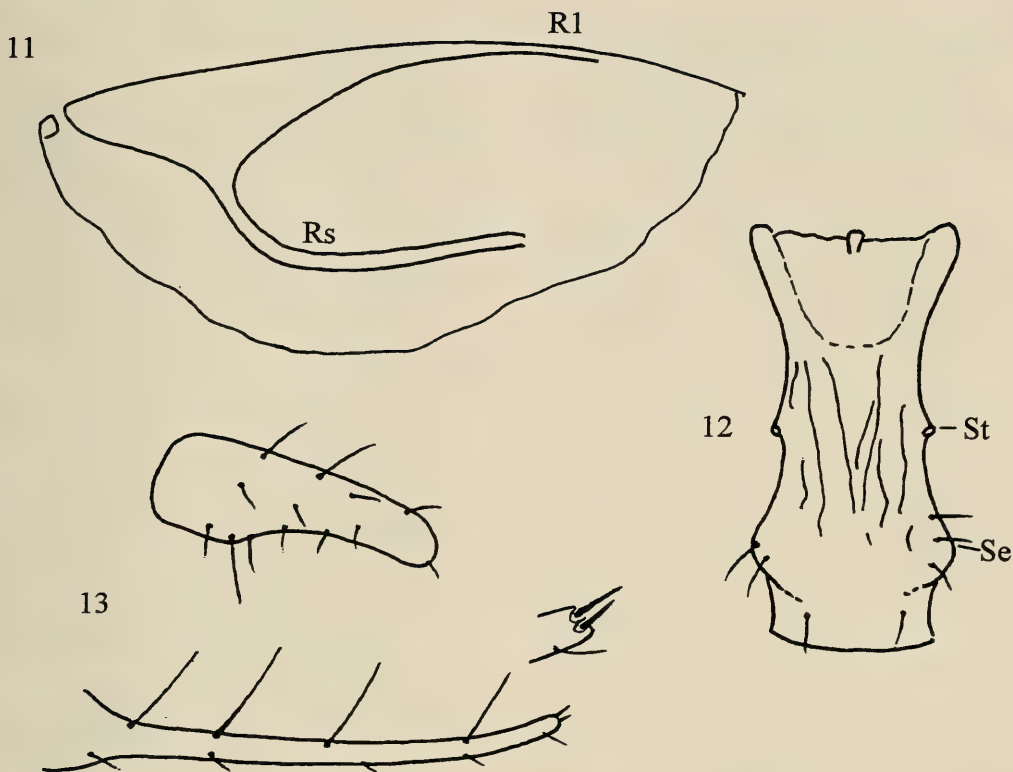
Genitalia (Fig. 13). Prong slightly arcuate, with four semi-erect long setae on upper margin that are several times longer than prong diameter; 4 oblique shorter setae on lower margin about equal to prong diameter; with two simple oblique setae or bristles at apex.

Coloration. Head dark brown, clypeus and malar space light brownish; mouthparts yellowish. Antenna brown except scape, pedicel and F₁ yellowish. Mesosoma dark brown, prothorax brownish. Wing venation light brown. Leg yellow; middle and hind coxa, and tarsal apex somewhat darker. Metasoma brown; tergum 1 and central portion of tergum 2 yellow brown; apex of metasoma lighter, basal $\frac{2}{3}$ of prong yellowish.

Length of body about 1.9 mm.

Male. Unknown.

Holotype [♀].—USA, WA, Kittitas Co., Lost Lake, 7-VII-1994, coll. K. Pike & G. Graf. Host: *Aphis helianthi* Monell, *Aphis* nr. *varians* Patch, *Aphis* sp. on *Epilobium an-*



Figs. 11–13. *Binodoxys grafi*, ♀ (illustrations not to equal scale). 11, Forewing, in part. 12, Metasomal tergum 1. 13, Genitalia, in part. Abbreviations: R1, postmarginal vein; Rs, Radial sector; Se, secondary tubercle; St, spiracular (= primary) tubercle.

gustifolium, sample no. 94K056. Deposited in USNM. Additional material deposited in part in the Washington State University Collection, James Museum, Pullman, WA; the Washington State University Collection-Prosser, WA; and the collection of P. Starý, České Budějovicé, Czech Republic.

B. sp.

Aphis salicariae Koch: WA, Yakima Co., Ahtanum Valley, 3-VI-94, on *Cornus stolonifera* (94-064).

Illinoia rhododendri (Wilson): WA, Kittitas Co., 7-VII-94, on *Rhododendron albiflorum* (94K043).

Genus *Diaeretiella* Starý

D. rapae (M'Intosh)

Brachycorynella asparagi (Mordvilko): WA, Benton Co., WSU-Prosser,

13-IX-94, on *Asparagus officinalis* (94R203).

Braggia sp.: WA, Yakima Co., Naches, 9-VI-94, on *Eriogonum elatum* (94-139).

Brevicoryne brassicae (L.): WA, Benton Co., Prosser, 11-X-94, on *Brassica oleracea* (94K117); 27-V-94, 15-VI-94, on *Brassica napus* (94-041, 94K003); and 27-V-94, on *Descurainia sophia* (94-042). WA, Skagit Co., Mt Vernon, 8-IX-94, on *Brassica oleracea* coll. A. Anderson (94R201). WA, Whitman Co., Pullman, 13-VII-93, on *Brassica napus* (93T005).

Diuraphis noxia (Kurdjumov): WA, Adams Co., near Ritzville, 15-VI-91 (91A017), and LaCross, 25-V-94 (94-038), on *Triticum aestivum*. WA,

- Asotin Co., near Anatone, 1993, on *Triticum aestivum* (93T006). WA, Benton Co., Gap & Snipes Rd, 7-V-91 (91A011), Horse Heavens, 14-VI-94 (94K001, 94K002), WSU-Prosser, XI-89, 23-IV-91, 7 & 20-V-91, 8-VIII-91, 17 & 24-IV-92, 1-V-92, 17, 24, 25 & 27-V-94, 13-VI-94, 17 & 28-X-94 (89A002, 89A003, 91A004-91A006, 91A008-91A016, 91A018, 92A005, 92A009, 92K001, 94-006, 94-030, 94-031, 94-045, 94-145, 94G086, 94G094), on *Triticum aestivum*, and 17 & 31-V-94, 2-VI-94 on *Hordeum vulgare* (94-011, 94-049, 94-050). WA, Franklin Co., Kahlotus, 4-VI-91, on *Triticum aestivum* (91A016). WA, Klickitat Co., Bickleton, 7-VI-94, 1-VII-94, on *Triticum aestivum* (94-088, 94K097); 7-VI-94, on *Aegilops cylindrica* (94-089); and Goldendale, 7-VI-94, on *Triticum aestivum* (94-103). WA, Whitman Co., Colfax, 29-VI-94 (94K017), near Dusty, 23-VIII-93 (93T007), and near Pullman, 5-VII-94 (94T021), on *Triticum aestivum*. WA, Yakima Co., Donahoe Rd., 18-VI-94, on *Hordeum vulgare* (94G001), and Glade Rd, 7-VI-94 (94-087), Grandview, 29-V-94 (94-047), and Sunnyside, 10-X-94 (94G074) on *Triticum aestivum*.
- Hayhurstia atriplicis* (L.): WA, Yakima Co., near Sunnyside, 3 & 25-IX-94, 10-X-94, on *Chenopodium album* (94G015, 94G028, 94G071).
- Macrosiphum euphorbiae* (Thomas): WA, Pierce Co., Mt. Rainier National Pk, White River CG, 18-VIII-94, on *Epilobium angustifolium* (94R117).
- Macrosiphum* sp.: WA, Asotin Co., near Field Springs State Pk, 24-VIII-93, on *Triticum aestivum* (93T015).
- Myzus persicae* (Sulzer): WA, Benton Co., WSU-Prosser, 2-XI-94, on *Brassica* sp. (94A004). WA, Skagit Co., Mt. Vernon, 8-XI-94, on *Brassica oleracea*, coll. A. Anderson (94R201).
- Myzus* sp.: WA, Whitman Co., Pullman, 14-IX-93, on *Forsythia* sp. (93T019).
- Phorodon humuli* (Schrank): WA, Benton Co., WSU-Prosser, 13-IX-94, 7-XI-94, on *Humulus lupulus*, coll. W. Cone (94R202, 94W004).
- Rhopalosiphum maidis* (Fitch): WA, Benton Co., WSU-Prosser, 21-X-94, 23-XI-94, on *Panicum milliaceum* (94G093, 94G106).
- Rhopalosiphum padi* (L.): WA, Benton Co., WSU-Prosser, 17-IV-92, 1 & 8-V-92, 27-V-94, 17-X-94 on *Triticum aestivum* (92A004, 92A006, 92A012, 92A017, 92A018, 94-045, 94G086), and 27-V-94, on *Hordeum vulgare* (94-043). WA, Yakima Co., near Sunnyside, 10-X-94, on *Triticum aestivum* (94G074).
- Sitobion avenae* (F.): WA, Benton Co., WSU-Prosser, 27-VI-94, on *Triticum aestivum* (94K098). WA, Klickitat Co., near Bickleton, 1-VII-94, on *Triticum aestivum* (94K097). WA, Whitman Co., near Pullman, 19-VII-93, on *Triticum aestivum* (93T012).
- Mixed aphids: *Diuraphis noxia* (Kurdjumov), *Rhopalosiphum padi* (L.), *Sitobion avenae* (F), WA, Klickitat Co., Bickleton, 23-VII-93, on *Hordeum vulgare* (93K006), and *Triticum aestivum* (93K007).

Genus *Ephedrus* Haliday

E. californicus Baker

- Acyrtosiphon laticae* (Passerini): WA, Asotin Co., near Anatone, 10-IX-93, on *Lactuca serriola* (93T018).
- Aphthargelia symphoricarpi* (Thomas): WA, Kittitas Co., Lost Lake, 7-VII-94, on *Symphoricarpos* sp. (94K047, 94K050).
- Chaetosiphon fragaefolii* (Cockerell): ID, Boundary Co., Kootenay Wildlife Refuge, 26-VII-94, on *Rosa* sp. (94R026a).

Macrosiphum euphorbiae (Thomas): WA, Kittitas Co., Lost Lake, 7-VII-94, on *Rosa* sp. (94K045). WA, Yakima Co., Bird Creek Meadows, 8-IX-94, on *Ligusticum grayi* (94R175).

Macrosiphum rosae (L.): WA, Yakima Co., Grandview, 25-V-94, 25-IX-94 on *Rosa* sp. (94-028, 94G023).

Uroleucon russellae (Hille Ris Lambers): MT, Sanders Co., W. Fork Thompson River, 26-VII-94, on *Anaphalis margaritacea* (94R028).

Uroleucon sp.: WA, Asotin Co., 7-IX-93, on *Dipsacus sylvestris* (93T009). WA, Yakima Co., Tampico, 20-VII-94, on *Aster* sp. (94R002).

Mixed aphids: *Chaetosiphon tetrahodum* (Walker), *Fimbriaphis wakibae* (Hottes), and *Macrosiphum euphorbiae* (Thomas), WA, Kittitas Co., Lost Lake, 7-VII-94, on *Rosa* sp. (94K045).

Undetermined aphid: WA, Asotin Co., 7-IX-93, on *Dipsacus sylvestris* (93T008).

E. spp.

Aphis coweni Palmer: WA, Kittitas Co., Lost Lake, 7-VII-94, on *Veratrum viride* (94K049).

Aphis varians Patch: MT, Sanders Co., W. Fork Thompson River, 26-VII-94 (94R029), and Thompson Pass, 27-VII-94 (94R040), on *Epilobium angustifolium*.

Uroleucon sp.: WA, Whitman Co., Pullman, 25-IX-93, on *Lactuca serriola* (93T023).

Mixed aphids: *Illinoia rhododendri* (Wilson) and undetermined sp., WA, Yakima Co., Bird Creek Meadows, 9-IX-94, on *Vaccinium* sp. (94R177).

Genus *Euaphidius* Mackauer

E. cingulatus (Ruthe)

Pterocomma bicolor (Oestlund): WA, Pierce Co., Mt. Rainier National Pk,

Westside Rd., 15-IX-94, on *Salix* sp. (94R207, 94R209).

Pterocomma sp.: OR, Multnomah Co., Multnomah Falls, 4-IV-92, on *Salix* sp. (92A003).

E. setiger (Mackauer)

Periphyllus lyropictus (Kessler): WA, Benton Co., WSU-Prosser, 28-V-94, on *Acer platanoides* (94-046).

Genus *Lysiphlebus* Förster

L. flavidus Gahan

Cedoaphis incognita Hottes & Frison: WA, Yakima Co., Clear Lake, 24-VI-92, on *Symphoricarpos* sp. (92A001).

L. testaceipes (Cresson)

Acyrtosiphon lactucae (Passerini): WA, Asotin Co., near Anatone, 10-IX-93, on *Lactuca serriola* (93T018). WA, Kittitas Co., Ellensburg, 26-IX-94, on *Lactuca serriola* (94G041).

Aphis armoraciae Cowen: WA, Kittitas Co., Lost Lake, 7-VII-94, on *Mertensia paniculata* (94K030).

Aphis helianthi Monell: WA, Kittitas Co., Lost Lake, 7-VII-94, on *Heracleum lanatum* (94K032). WA, Pierce Co., Mt. Rainier National Pk, Cayuse Pass, 2-VIII-94, on *Cirsium* sp. (94R064), and 11 & 18-VIII-94, on *Heracleum lanatum* (94R091, 94R108, 94R110). WA, Pierce Co., Crystal Mt., 3-VIII-94, on *Heracleum lanatum* (94R081). WA, Skamania Co., Trout Lake, 8-VI-94, on *Ligusticum apiifolium* (94-113). WA, Yakima Co., Ravens Roost, 10-VII-94, on *Cirsium* sp. (94G008).

Aphis holodisci Robinson: WA, Yakima Co., Ahtanum Valley, 3-VI-94, on *Holodiscus discolor* (94-076).

Aphis lugentis Williams: WA, Yakima Co., Bird Creek Meadows, 8-IX-94, on *Arnica* sp. (94R171), and *Senecio triangularis* (94R179), and Bird

- Lake, 8-IX-94, on *Senecio triangul-
laris* (94R165).
- Aphis neogillettei* Palmer: WA, Skamania
Co., Trout Lake, 8-VI-94, on *Cornus
stolonifera* (94-119).
- Aphis nerii* Boyer de Fonscolombe: WA,
Benton Co., County Line Rd & I-82,
7-IX-94 (94R143), and Prosser,
10-IX-94 (94G016), on *Asclepias
speciosa*. WA, Yakima Co., near Sun-
nyside, 10-VIII-94, 3-X-94 on *Ascle-
pias speciosa* (94G013, 94G065).
- Aphis rumicis* L.: WA, Benton Co.,
WSU-Prosser, 17-V-94, on *Rumex
crispus* (94-008).
- Aphis sambuci* L.: WA, Pierce Co., Mt.
Rainier National Pk, near Paradise,
29-IX-94, on *Sambucus racemosa*
(94R263).
- Aphis spiraecola* Patch: WA, Benton Co.,
Hanford ALE, 29-VIII-94, on *Lac-
tuca serriola* (94K112).
- Aphis varians* Patch: MT, Sanders Co.,
W. Fork Thompson River, 26-VII-
94, on *Castilleja* sp. (94R029). WA,
Pierce Co., Mt. Rainier National Pk,
Cayuse Pass, 2-VIII-94 (94R065),
and White River CG, 18-VIII-94
(94R118), on *Epilobium angustifol-
ium*. WA, Yakima Co., Green Lake,
31-VIII-94, on *Epilobium angusti-
folium* (94R140).
- Aphis* sp.: WA, Kittitas Co., Lost Lake,
7-VII-94, on *Pedicularis bracteosa*
(94K029), and *Senecio triangularis*
(94K039). WA, Klickitat Co.,
Glennwood, 8-IX-94, on *Rheum rha-
barbarum* (94R155). WA, Yakima
Co., Green Lake Rd, 31-VIII-94, on
Umbelliferae (94R137).
- Apthargelia symphoricarpi* (Thomas):
WA, Kittitas Co., Lost Lake, 29-VI-
94, 7-VII-94, on *Symphoricarpos* sp.
(94G005, 94K047, 94K050). WA,
Skamania Co., Trout Lake, 8-VI-94,
on *Symphoricarpos albus* (94-116).
- Brachycaudus cardui* L.: WA, Benton
Co., Bennett Springs, 4-X-94, on
Cirsium vulgare (94G069).
- Brachycaudus helichrysi* (Kaltenbach):
WA, Kittitas Co., Manashtash, 26-IX-
94, on *Rudbeckia hirta* (94G042).
- Brachycaudus tragopogonis* (Kalten-
bach): WA, Klickitat Co., Glen-
wood, 8-IX-94, on *Tragopogon du-
bius* (94R150).
- Brachycorynella asparagi* (Mordvilko):
WA, Benton Co., WSU-Prosser,
13-IX-94, on *Asparagus officinalis*
(94R203).
- Braggia eriogoni* (Cowen): WA, Klicki-
tat Co., Bickleton, 7-VI-94, on *Er-
iogonum heracleoides* (94-094).
- Braggia* sp.: WA, Yakima Co., Ahtanum
Valley, 3-VI-94, on *Eriogonum com-
positum* (94-73), and Naches, 9-VI-
94, on *Eriogonum elatum* (94-139).
- Diuraphis noxia* (Kurdjumov): WA, Ben-
ton Co., Gap & Snipes Rd, 23-IV-91
(91A007), WSU-Prosser, 23-IV-91,
17 & 24-IV-92, 1-V-92, 28-X-94
(91A004, 91A005, 91A008, 92A005,
92A009, 92A011, 94G094), on *Trit-
icum aestivum*. WA, Yakima Co.,
near Sunnyside, 8 & 30-VI-94, 10-X-
94, on *Triticum aestivum* (94A007,
94A009, 94G074).
- Macrosiphum euphorbiae* (Thomas):
WA, Pierce Co., Mt. Rainier Nation-
al Pk, White River CG, 18-VIII-94,
on *Epilobium angustifolium* (94R117).
- Myzus ascalonicus* Doncaster: WA, Ya-
kima Co., White Pass, 18-VIII-94,
on moss (94R106).
- Nearctaphis clydesmithi* Hille Ris Lam-
bers: WA, Klickitat Co., Brooks Me-
morial Pk, 8-VI-94, on *Crataegus
douglasii* (94-100).
- Phorodon humuli* (Schrank): WA, Benton
Co., WSU-Prosser, 23-V-94, on *Pru-
nus salicina* (94-026). WA, Benton
Co., WSU-Prosser, 13 & 28-IX-94,
on *Humulus lupulus* (94R202,
94R250).
- Rhopalosiphum maidis* (Fitch): WA, Ben-
ton Co., Bennett Springs, 4-X-94, on
Echinochloa crus-galli (94G066);
WSU-Prosser, XI-89, on *Triticum*

aestivum (89A001) and 21 & 23-X-94, on *Panicum milliaceum* (94G093, 94G105, 94G106).

Rhopalosiphum padi (L.): WA, Benton Co., Bennett Springs, 4-X-94, on *Echinochloa crus-galli* (94G066); WSU-Prosser, 17 & 24-IV-92, 1-V-92, 25-VIII-92 on *Triticum aestivum* (92K002, 92A006, 92A007, 92A012, 92A017), and 17-X-94, on *Zea mays* (94G085). WA, Yakima Co., near Sunnyside, 10-X-94, on *Triticum aestivum* (94G074).

Sitobion avenae (F.): WA, Asotin Co., near Anatone, 12-VII-94, on *Triticum aestivum* (94T023).

Uroleucon cirsiif? (L.): WA, Pierce Co., Mt. Rainier National Pk, Longmire, 15-IX-94, on *Cirsium arvense* (94R212).

Undetermined aphids: WA, Asotin Co., near Anatone, 15-IX-93, on *Helianthus* sp. (93T021); near Asotin, 7-IX-93, on *Chrysothamnus nauseosus* (93T026); and Field Springs State Pk, 5 & 24-VIII-93, on *Cirsium arvense* (93T010, 93T014). WA, Benton Co., Bennett Springs, 4-X-94, on *Cirsium vulgare* (94G068); Rattlesnake Hills, 27-IX-94, swarm above *Triticum aestivum* stubble (94G040). WA, Whitman Co., near Dusty, 7-VII-93, on *Lupinus* sp. (93T011).

L. sp.

Aphis helianthi Monell: WA, Pierce Co., Mt. Rainier National Pk, near Cayuse Pass, 11-VIII-94, on *Heracleum lanatum* (94R091).

Aphis sp.: WA, Pierce Co., Mt. Rainier National Pk, near Cayuse Pass, 11-VIII-94, on *Heracleum lanatum* (94R091). WA, Yakima Co., Green Lake, 31-VIII-94, on Umbelliferae (94R137).

Brachycaudus tragopogonis (Kaltenbach): WA, Klickitat Co., Glen-

wood, 8-IX-94, on *Tragopogon dubius* (94R150).

Genus *Monoctonus* Haliday

M. washingtonensis Pike & Starý

Diuraphis noxia (Kurdjumov): WA, Benton Co., WSU-Prosser, Roza Farm, 17-IV-92, on *Triticum aestivum* (92A005) [see Pike & Starý 1995b].

Rhopalosiphum padi (L.): WA, Benton Co., WSU-Prosser, 1, 8 & 15-V-92, on *Triticum aestivum* (92A017–92A019) [see Pike & Starý 1995b].

M. sp.

Acyrtosiphon pisum (Harris): WA, Kittitas Co., Lost Lake, 7-VII-94, on *Rhododendron albiflorum* (94K031).

Illinoia rhododendri (Wilson): WA, Kittitas Co., Lost Lake, 7-VII-94, on *Rhododendron albiflorum* (94K043).

Illinoia sp.: WA, Yakima Co., Green Lake, 20-VII-94, on *Rhododendron albiflorum* (94R006).

Metopolophium dirhodum (Walker): WA, Kittitas Co., Lost Lake, 7-VII-94, on *Rhododendron albiflorum* (94K027).

Genus *Pauesia* Quilis

P. ahtanumensis Pike & Starý

Cinara ponderosae (Williams): WA, Skamania Co., Trout Lake, 8-VI-94, on *Pinus ponderosa* (94-107). WA, Yakima Co., Ahtanum Valley, 3-VI-94, on *Pinus ponderosa* (94-065, 94-066) [see Pike & Starý 1996].

P. pahtonis Pike & Starý

Cinara ponderosae (Williams): WA, Skamania Co., Goose Lake, 8-VI-94, on *Pinus ponderosa* (94-131) [see Pike & Starý 1996].

P. ponderosaecola Pike & Starý

Cinara ponderosae (Williams): WA, Skamania Co., Trout Lake, 8-VI-94, on *Pinus ponderosa* (94-107, 94-112).

WA, Yakima Co., Ahtanum Valley, 3-VI-94, on *Pinus ponderosa* (94-065, 94-066) [see Pike & Starý 1996].

P. pseudotsugae Pike & Starý, new species (Figs. 14–24)

Diagnosis.—According to a key by Smith (1944) the new species keys to *P. gillettei* (Gahan), but differs from it in the number of antennal segments (*P. pseudotsugae* [♀], 24 segments; *P. gillettei* [♀], 21 segments).

Etymology.—The name of the new species is derived from the association of its host aphid *Cinara pseudotaxifoliae* Palmer on Douglas fir, *Pseudotsuga menziesii*.

Description.—*Female*. Head. Tentoriocular line $\frac{1}{3}$ shorter than intertentorial line, and slightly shorter than malar space. Eye length $3\times$ malar space. Eyes with sparse short setae. Antenna 24-segmented, filiform, slightly thinned in apical half (Fig. 21–24). Flagellomere 1–10 equal in length, each about $1.5\times$ as long as wide, remaining flagellomeres gradually decreasing in length to apex. Flagellomeres in apical half slightly narrower than basal portion.

Mesosoma. Mesonotum (Fig. 15) with crenulate-rugose notauli distinct in ascendent portion; surface delicately granularly punctate, sparsely setose along effaced notauli on disc; central lobe with longitudinal glabrous spot; lateral lobes with small glabrous areas. Propodeum (Fig. 17) with distinct, broad, deeply excavated, smooth, glabrous areola; lateral rami well developed, longitudinal rami somewhat incomplete but distinct; lateral upper areolae with relatively dense long setae.

Forewing (Fig. 16): Stigma about $2.5\times$ as long as wide, distal abscissa of R1 about $\frac{1}{6}$ shorter than stigma; rs vein distinctly shorter than width of stigma, about $1.5\times$ as long as 3/Rs; 2/Rs subequal to half of rs; lower margin setae twice as long as surface setae.

Leg. Hind femur with adpressed setae on the upper margin and erect setae on the

lower margin. Hind tibia with adpressed setae on both margins.

Metasoma. Tergum 1 (Fig. 14) slender, length $3.5\times$ width at spiracles, width at apex $<2\times$ width at spiracles; spiracular tubercles prominent laterally; longitudinally rugose, with distinctly prominent longitudinal keeliform rugosity in middle third of tergum, and with sparse long setae.

Genitalia (Figs. 18–20): Ovipositor sheath broad, apical setae with tubiform base.

Coloration. Head yellow orange, occipital area brown; mouthparts bright yellow. Antennal scape yellow-orange, pedicel brown with yellow orange rings at each end, remaining segments dark brown. Mesosoma distinctly bicolorous, prevalently yellow orange. Prothorax, mesonotum yellow orange. Mesopleuron yellow orange with brown in central and lower portion. Scutellum brown with yellow orange in center. Metanotum and metapleuron brown. Propodeum brown and yellow orange; upper lateral areolae and lower corners of lower areola brown. Stigma bicolorous, brown with yellowish base. Legs yellow, apex of hind tarsi and tibiae brownish. Metasoma yellow orange; tergum 1 with somewhat darkened apex; terga 2 and 3 with darkened central spots, remaining terga with brownish banding in distal third. Ovipositor sheath brown.

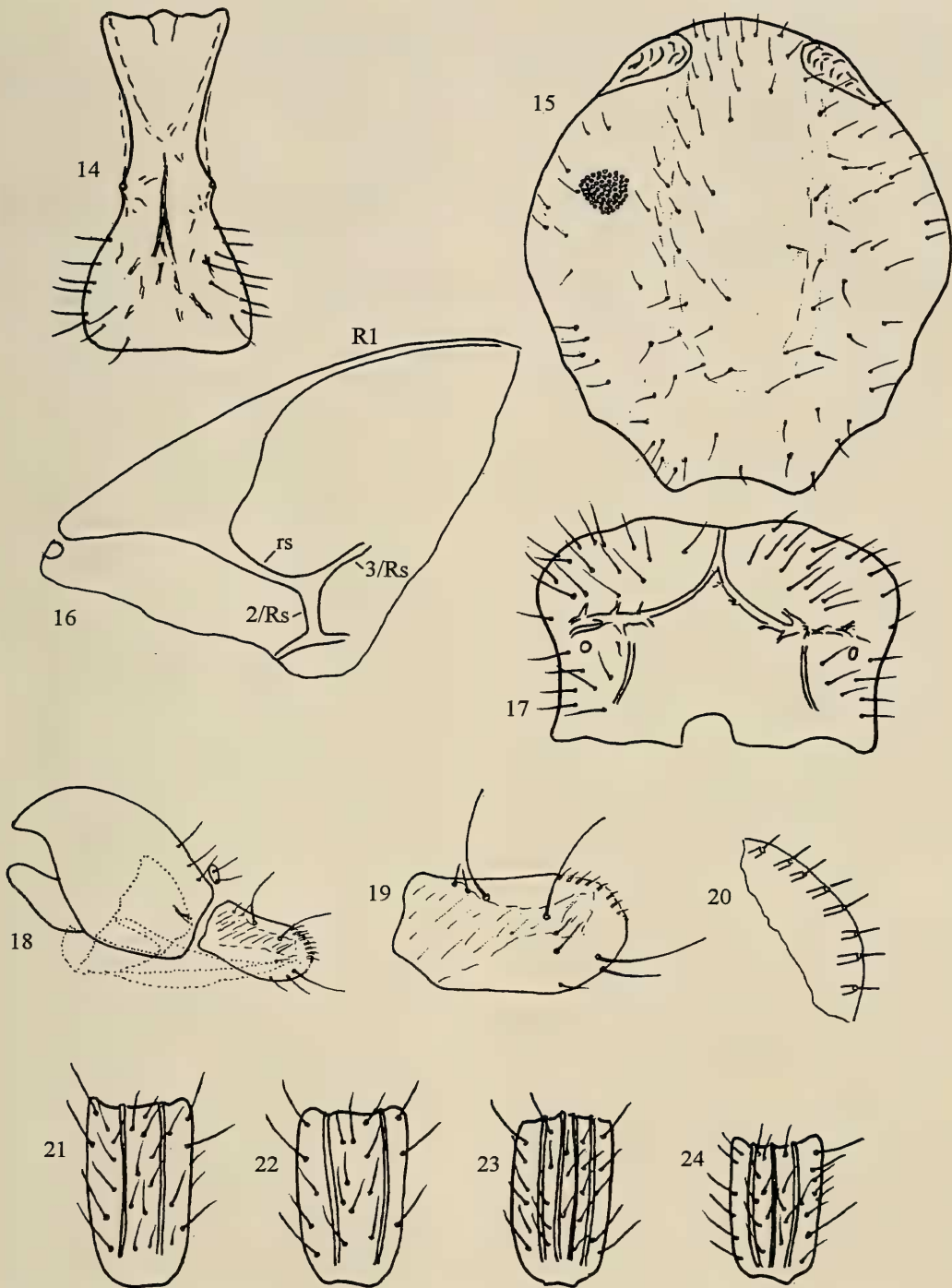
Length of body about 4.5 mm.

Male: Unknown.

Holotype [♀].—USA, WA, Kittitas Co., Lost Lake, 7-VII-1994, coll. K. Pike & G. Graf.

Host.—*Cinara pseudotaxifoliae* Palmer on *Pseudotsuga menziesii*, sample no. 94K025. Deposited in USNM.

Paratype.—♀ (mounted on slide), same data as holotype. In the collection of P. Starý, České Budějovicé, Czech Republic. Additional material deposited in the Washington State University Collection, James Museum, Pullman, Washington, and Washington State University Collection—Prosser, WA.



Figs. 14-24. *Pauesia pseudotsugae*, ♀ paratypes (illustrations not to equal scale). 14, Metasomal tergum 1. 15, Mesonotum; granularly punctate structure drawn for left lobe only. 16, Forewing, in part. 17, Propodeum. 18, Genitalia. 19, Ovipositor sheath. 20, Apex of ovipositor sheath. 21, Flagellomere 2. 22, Flagellomere 4. 23, Flagellomere 12. 24, Flagellomere 18. Abbreviations: R1, postmarginal vein; rs, 2/Rs, and 3/Rs, wing veins.

P. juniperaphidis (Gahan)

Cinara pilicornis (Hartig): WA, Yakima Co., Yakima Arboretum, 3-VI-94, on *Picea pungens* (94-061).

P. sp.

Cinara pseudotsugae (Wilson): WA, Yakima Co., Ahtanum Valley, 3-VI-94, on *Pseudotsuga menziesii* (94-078).

Genus *Praon* Haliday***P. exsoletum*** (Nees)

Therioaphis trifolii maculata (Buckton): WA, Benton Co., WSU-Prosser, 17-V-94, 25-VIII-94, on *Medicago sativa* (94-014, 94R126).

P. occidentale Baker

Aphis sp.: WA, Yakima Co., Bird Creek Meadows, 8-IX-94 on *Arnica* sp. (94R172).

Diuraphis noxia (Kurdjumov): WA, Benton Co., WSU-Prosser, 17-IV-92, 1-V-92, on *Triticum aestivum* (92A005, 92A014, 92A016).

Illinoia sp.: WA, Kittitas Co., Lost Lake, 7-VII-94, on *Aquilegia formosa* (94K036).

Macrosiphum rosae (L.): WA, Yakima Co., Grandview, 25-V-94, 25-IX-94, on *Rosa* sp. (94-029, 94G023).

Rhopalosiphum padi (L.): WA, Benton Co., WSU-Prosser, 24-IV-92, 8-V-92, on *Triticum aestivum* (92A010, 92A018).

Uroleucon sp.: WA, Skamania Co., South Prairie, 8-IX-94, on *Aster* sp. (94R190).

P. pequodorum Viereck

Acyrtosiphon pisum (Harris): WA, Benton Co., WSU-Prosser, 25-VIII-94, on *Medicago sativa* (94R124).

Uroleucon ivae Robinson: WA, Yakima Co., Sunnyside, 13-VII-94, on *Iva xanthifolia* (94G009).

P. unicum Smith

Acyrtosiphon latucae (Passerini): WA, Kittitas Co., Ellensburg, 26-IX-94, on *Lactuca serriola* (94G041).

Aphis coweni Palmer: WA, Skamania Co., Taklakh Lake, 16-VIII-94, on *Veratrum viride* (94G014). WA, Yakima Co., Bird Creek Meadows, 8-IX-94, on *Veratrum viride* (94R174).

Aphis rumicis L.: WA, Benton Co., WSU-Prosser, 21-V-94, on *Rumex crispus* (94-022, 94-025).

Diuraphis noxia (Kurdjumov): WA, Benton Co., WSU-Prosser, 17-IV-92, 1-V-92, 25-V-94, on *Triticum aestivum* (92A005, 92A016, 94-030).

Macrosiphum euphorbiae (Thomas): WA, Yakima Co., Grandview, 27-X-94, on *Solanum lycopersicum* (94R267).

Rhopalosiphum maidis (Fitch): WA, Benton Co., WSU-Prosser, XI-94, on *Panicum milliaceum* (94G107).

Rhopalosiphum padi (L.): WA, Benton Co., WSU-Prosser, 17 & 24-IV-92, 1, 8 & 15-V-92, on *Triticum aestivum* (92A006, 92A008, 92A010, 92A015, 92A017-92A019), and 27-V-94, on *Hordeum vulgare* (94-043).

P. yakimanum Pike & Starý

Diuraphis noxia (Kurdjumov): WA, Benton Co., WSU-Prosser, 25-V-94, on *Triticum aestivum* (94-031) [see Pike & Starý 1995b].

Rhopalosiphum padi (L.): WA, Benton Co., Horse Heavens, 1-V-92 (92A013); WSU-Prosser, 17-IV-92, 1-V-92, 1-V-93, on *Triticum aestivum* (92A006, 92A017, 93A002), and 27-V-94, on *Hordeum vulgare* (94-043) [see Pike & Starý 1995b].

P. spp.

Acyrtosiphon pisum (Harris): MT, Sanders Co., Plains, 26-VII-94, on *Lathyrus odoratus* (94R034).

- Aphis armoraciae* Cowen: WA, Kittitas Co., Lost Lake, 7-VII-94, on *Mertensia paniculata* (94K030).
- Aphis coweni* Palmer: WA, Kittitas Co., Lost Lake, 7-VII-94, on *Veratrum viride* (94K049).
- Aphis pomi* de Geer: WA, Yakima Co., Sunnyside, 25-IX-94, on *Pyrus malus* (94G029).
- Aphthargelia symphoricarpi* (Thomas): WA, Kittitas Co., Lost Lake, 29-VI-94, on *Symphoricarpos* sp. (94G005).
- Ceruraphis viburnicola* (Gillette): WA, Skamania Co., South Prairie, 8-IX-94, on *Carex* sp. (94R191).
- Chaetosiphon fragaefolii* (Cockerell): ID, Boundary Co., Kootenay Wildlife Refuge, 26-VII-94, on *Rosa* sp. (94R026a).
- Eoessigia longicauda* (Richards): WA, Skamania Co., South Prairie, 8-IX-94, on *Spiraea* sp. (94R194).
- Hyperomyzus* sp.: WA, Benton Co., WSU-Prosser, 11-VI-94, on *Sonchus oleraceus* (94-144).
- Illinoia rhododendri* (Wilson): WA, Kittitas Co., Lost Lake, 7-VII-94, on *Rhododendron albiflorum* (94K043).
- Macrosiphum rosae* (L.): WA, Yakima Co., Grandview, 25-IX-94, on *Rosa* sp. (94G023).
- Myzus cerasi* (F.): WA, Benton Co., WSU-Prosser, 27-VI-94, on *Prunus avium* (94K015).
- Myzus* sp.: WA, Whitman Co., Pullman, 14-IX-93, on *Forsythia* sp. (93T019).
- Uroleucon ivae* Robinson: WA, Yakima Co., near Grandview, County Line Rd & I-82, 11-VIII-94, on *Iva xanthifolia* (94R094).
- Uroleucon russellae* (Hille Ris Lambers): WA, Skamania Co., Ice Cave near Trout Lake, 8-IX-94, on *Anaphalis margaritacea* (94R188).
- Mixed aphids: *Acyrtosiphon latucae* (Passerini) and *Macrosiphum euphorbiae* (Thomas), WA, Yakima Co., near Sunnyside, 16-X-94, on *Lactuca serriola* (94G083). *Chaetosiphon tetrahodum* (Walker), *Fimbriaphis wakibae* (Hottes), *Macrosiphum euphorbiae* (Thomas), WA, Kittitas Co., Lost Lake, 7-VII-94, on *Rosa* sp. (94K045). *Hayhurstia atriplicis* (L.) and *Macrosiphum euphorbiae* (Thomas), WA, Yakima Co., near Sunnyside, 10-X-94, on *Che-nopodium album* (94G071). *Hyperomyzus lactucae* (L.) and *Macrosiphum euphorbiae* (Thomas), WA, Benton Co., WSU-Prosser, 20-X-94, on *Sonchus oleraceus* (94G092). *Illinoia rhododendri* (Wilson) and undetermined sp., WA, Yakima Co., Bird Creek Meadows, 8-IX-94, on *Vaccinium* sp. (94R177). *Rhopalosiphum maidis* (Fitch) and *R. padi* (L.), WA, Benton Co., Bennett Springs, 4-X-94, on *Echinochloa crus-galli* (94G066). *Sitobion clydesmithi* Robinson and *Sitobion* sp., WA, Skamania Co., Pinto Rock, 25-IX-94, on *Pteridium aquilinum* (94G022).
- Undetermined aphid: MT, Sanders Co., Thompson Pass, 27-VII-94, on *Senecio* sp. (94R038).

Genus *Trioxys* Haliday

T. cirsii (Curtis)

- Drepanosiphum platanooides* (Schrank): WA, Benton Co., WSU-Prosser, 17-V-94, on *Acer pseudoplatanus* (94-009) [parasitoid European in origin, new record for North America].

T. pallidus (Haliday)

- Chromaphis juglandicola* (Kaltenbach): WA, Yakima Co., Yakima Arboretum, 3-VI-94, on *Juglans regia* (94-053).
- Monelliopsis caryae* (Monell): WA, Benton Co., WSU-Prosser, 31-VIII-94, on *Juglans regia* (94R128). WA, Yakima Co., Sunnyside, 25-VII-94 (94K071), and Yakima Arboretum, 7-VII-94, on *Juglans nigra* (94K-020).

Myzocallis sp.: WA, Benton Co., WSU-Prosser, 21-VII-94, on *Quercus rubra* (94R011).

Panaphis juglandis (Goeze): WA, Benton Co., WSU-Prosser, 6-VII-94, on *Juglans regia* (94A001). WA, Yakima Co., Yakima Arboretum, 6-VII-94, on *Juglans regia* (94K021).

***T. rosae* Pike & Starý, new species**
(Figs. 25–32)

Diagnosis.—A combination of features characterize the new species: propodeum smooth, but with divergent carinae in lower portion; antenna 11-segmented; Rs vein of forewing short, about equal to stigma width; distal abscissa of R1 short, equal to $\frac{1}{3}$ stigma length; prongs, associated with genitalia, almost straight, with 5 nearly perpendicular setae on upper margin and two dilated setae or bristles at apex. The new species keys to *T. infrequens* Smith in Smith (1944), but differs in the shape of its prongs and metasomal tergum 1. Another species, *T. exareolatus* Viereck (1917), reported from Connecticut and attacking the same host as the new species, differs from *T. rosae* in the number, length, and arrangement of setae on the prongs.

Etymology.—The name of the species is derived from its host aphid, *Macrosiphum rosae* (L.).

Description.—*Female*. Head. Tentoriocular line equal to $\frac{1}{8}$ intertentorial line. Malar space equal to $\frac{1}{7}$ to $\frac{1}{6}$ eye length. Antenna 11-segmented, total length somewhat longer than head, mesosoma, and metasomal tergum 1 together, and widening to apex. Flagellomere 1 (F_1) (Fig. 26) length $3.5\times$ width, setae subequal to its width, without longitudinal placodes. F_2 (Fig. 27) slightly longer and wider than F_1 , length somewhat greater than $3\times$ width, setae equal to segment diameter, with 1 longitudinal placode. F_5 (Fig. 28), twice as long as wide, about $\frac{1}{3}$ wider than F_2 , setae equal to $\frac{1}{3}$ its width. F_8 twice as long as wide, wider than F_5 .

Mesosoma. Antescutal depression (Fig. 31) smooth, with sparse short setae. Meso-

notum with notauli crenulate and distinct in ascendent portion, effaced on disc as indicated by a simple row of sparse long setae. Propodeum (Fig. 29) smooth, divergent carinae in posterior declivity, with sparse setae.

Forewing (Fig. 30). Stigma triangular, length $2.5\times$ width; distal abscissa of R1 short, equal to $\frac{1}{3}$ stigma length; Rs vein short, equal to width of stigma; lower marginal setae $3\times$ length of surface setae.

Leg. Hind femur with sparse semierect setae, equal to $\frac{1}{3}$ segment diameter.

Metasoma. Tergum 1 (Fig. 25), length about $2\times$ width at spiracles, with sparse setae.

Genitalia (Fig. 32). Prong long, almost straight, slightly arcuate at apex, with two dilated setae at apex, 4–5 nearly perpendicular setae along upper margin (setal length greater than prong width distally, but only about $\frac{2}{3}$ prong width basally), 9–10 semierect setae on lower margin (setal length about $\frac{2}{3}$ prong width basally, somewhat shorter distally).

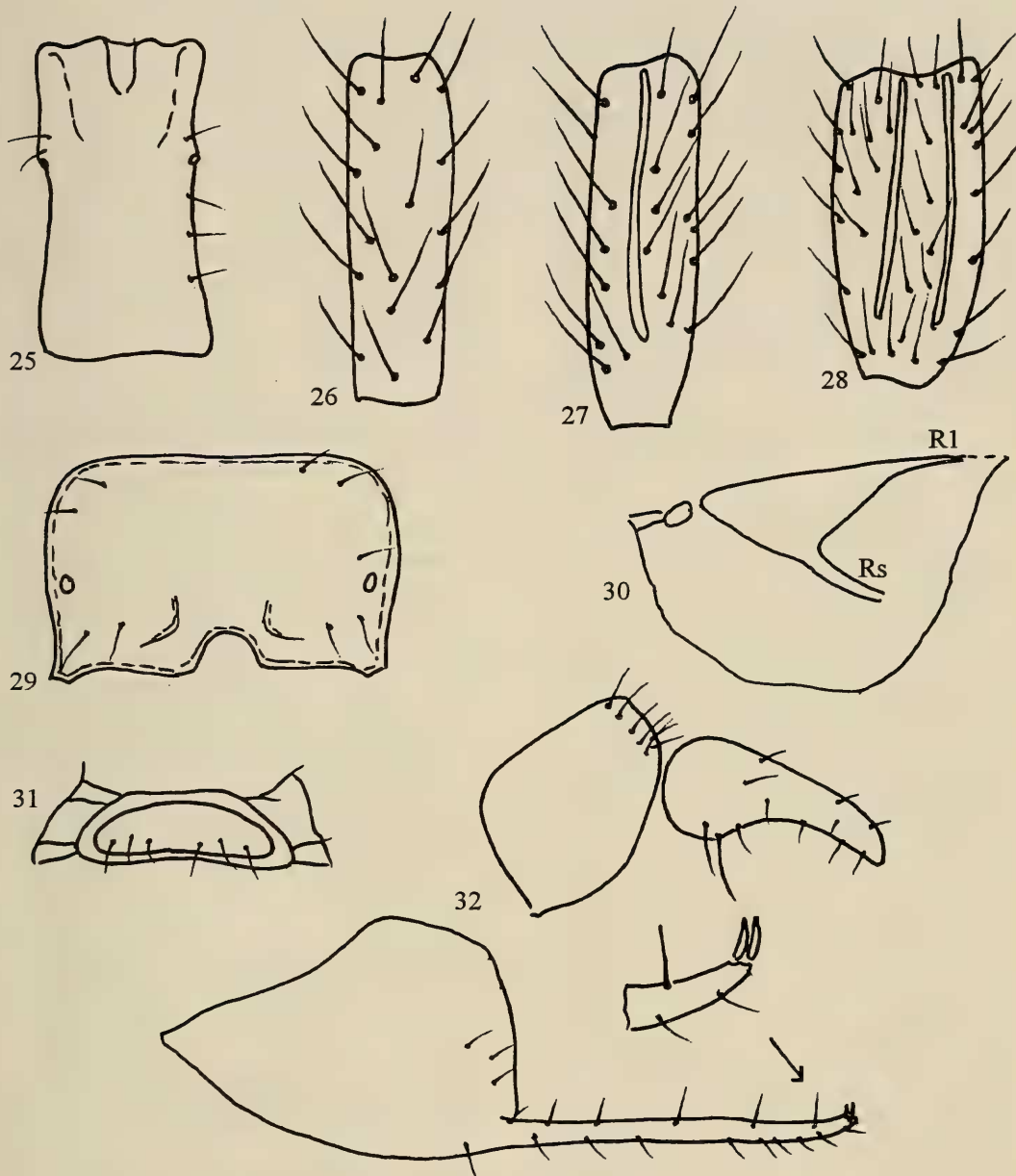
Coloration. Head dark brown. Clypeus brown, palpus light yellow. Antenna brown, excluding yellowish apex of pedicel and narrow base of F_1 . Mesosoma dark brown. Wing subhyaline, venation brownish. Tegula brown. Coxa dark brown, trochanter and trochantellus yellow brown; femur and tibia brown; tarsus yellow brown, excluding infusate apex. Metasoma, centrally brown, basal and apical third yellow brown. Ovipositor sheath and prong brown.

Length of body about 2 mm.

Male. Antenna 13-segmented. Body dark brown. Mouthparts light brown. Apex of pedicel light brown. Legs brown. Mesosoma brown, excluding tergum 1 yellow brown.

Holotype [\varnothing].—USA, WA, Yakima Co., Yakima Arboretum, 3-VI-94, coll. K. Pike & P. Starý. Host: *Macrosiphum rosae* (L.) on *Rosa* sp., sample no. 94-063. Deposited in USNM.

Paratypes.—11 $\varnothing\varnothing$, 2 $\sigma\sigma$ (pinned), same data as holotype. Deposited in part in



Figs. 25-32. *Trioxyx rosae*, ♀ paratypes (illustrations not to equal scale). 25, Metasomal tergum 1. 26, Flagellomere 1. 27, Flagellomere 2. 28, Flagellomere 5. 29, Propodeum. 30, Forewing, in part. 31, Antescutal depression. 32, Genitalia. Abbreviations: R1, postmarginal vein; RS, Radial sector.

the Washington State University Collection, James Museum, Pullman, Washington; the Washington State University Collection-Prosser, WA; and the collection of P. Starý, České Budějovicé, Czech Republic.

T. spp.

Aphis coweni Palmer: WA, Kittitas Co., Lost Lake, 7-VII-94, on *Veratrum viride* (94K049).

Pleotrichophorus sp.: WA, Yakima Co., Wiley City, 20-VII-94, on *Haploppappus resinus* (94R001).

Mixed aphids: *Euceraphis* sp. and *Oestlundia flava* [Davidson], WA, Skamania Co., Yellow Jacket, 25-IX-94, on *Trautvetteria carolinensis* (94G021).

Genus *Xenostigmus* Smith

X. bifasciatus (Ashmead)

Cinara ponderosae (Williams): WA, Yakima Co., Ahtanum Valley, 3-VI-94, on *Pinus ponderosa* (94-065).

Aphid Host-Parasitoid Index

Aphid name

Parasitoid name

Acyrtosiphon lactucae

Ephedrus californicus
Lysiphlebus testaceipes
Praon unicum Smith

Acyrtosiphon pisum

Aphidius ervi
Aphidius smithi
Aphidius sp.
Diaeretiella rapae
Monoctonus sp.
Praon pequodorum
Praon sp.

Aphis armoraciae

Aphidius sp.
Lysiphlebus testaceipes
Praon sp.

Aphis coweni

Ephedrus sp.
Praon unicum
Praon sp.
Trioxys sp.

Aphis helianthi

Lysiphlebus testaceipes
Lysiphlebus sp.

Aphis holodisci

Lysiphlebus testaceipes

Aphis lugentis

Lysiphlebus testaceipes

Aphis neogillettei

Lysiphlebus testaceipes

Aphis neri

Lysiphlebus testaceipes

Aphis pomi

Praon sp.

Aphis rumicis

Lysiphlebus testaceipes

Praon unicum

Aphis salicariae

Binodoxys sp.

Aphis sambuci

Lysiphlebus testaceipes

Aphis spiraeicola

Lysiphlebus testaceipes

Aphis varians

Aphidius sp.

Binodoxys carolinensis

Ephedrus sp.

Lysiphlebus testaceipes

***Aphis* sp.**

Aphidius sp.

Lysiphlebus testaceipes

Lysiphlebus sp.

Praon occidentale

Aphthargelia symphoricarpi

Ephedrus californicus

Lysiphlebus testaceipes

Praon sp.

Brachycaudus cardui

Lysiphlebus testaceipes

Brachycaudus helichrysi

Aphidius matricariae

Lysiphlebus testaceipes

Brachycaudus tragopogonis

Lysiphlebus testaceipes

Lysiphlebus sp.

Brachycorynella asparagi

Diaeretiella rapae

Lysiphlebus testaceipes

Braggia eriogoni

Lysiphlebus testaceipes

***Braggia* sp.**

Diaeretiella rapae

Lysiphlebus testaceipes

Brevicoryne brassicae

Aphidius ervi

Diaeretiella rapae

- Cedoaphis incognita***
Lysiphlebus flavidus
- Ceruraphis viburnicola***
Praon sp.
- Chaetosiphon fragaefolii***
Ephedrus californicus
Praon sp.
- Chaitophorus populicola***
Adialytus salicaphis
- Chaitophorus utahensis***
Adialytus salicaphis
- Chaitophorus* sp.**
Adialytus salicaphis
- Chromaphis juglandicola***
Trioxys pallidus
- Cinara pilicornis***
Pauesia juniperaphidis
- Cinara ponderosae***
Pauesia ahtanumensis
Pauesia pahtonis
Pauesia ponderosaecola
Xenostigmus bifasciatus
- Cinara pseudotaxifoliae***
Pauesia pseudotsugae
- Cinara pseudotsugae***
Pauesia sp.
- Diuraphis noxia***
Aphidius ervi
Aphidius sp.
Diaeretiella rapae
Lysiphlebus testaceipes
Monoctonus washingtonensis
Praon occidentale
Praon unicum
Praon yakimanum
- Drepanosiphum platanoides***
Trioxys cirsii
- Eoessigia longicauda***
Aphidius sp.
Praon sp.
- Euceraphis* sp.**
Trioxys sp.
- Hayhurstia atriplicis***
Diaeretiella rapae
- Hyperomyzus* sp.**
Aphidius sp.
Praon sp.
- Illinoia rhododendri***
Aphidius sp.
- Binodoxys* sp.
- Monoctonus* sp.
- Praon* sp.
- Illinoia* sp.**
Aphidius sp.
Monoctonus sp.
Praon occidentale
- Kakimia aquilegiae***
Aphidius kakimiaphidis
- Kakimia cynosbati***
Aphidius kakimiaphidis
- Kakimia* sp.**
Aphidius kakimiaphidis
Aphidius sp.
- Liosomaphis berberdis***
Aphidius hortensis
- Macrosiphoniella ludoviciana***
Aphidius ohioensis
- Macrosiphum albifrons***
Aphidius lupini
- Macrosiphum californicum***
Aphidius sp.
- Macrosiphum euphorbiae***
Aphidius polygonaphis
Diaeretiella rapae
Ephedrus californicus
Lysiphlebus testaceipes
Praon unicum
- Macrosiphum rosae***
Ephedrus californicus
Praon occidentale
Praon sp.
Trioxys rosae
- Macrosiphum* sp.**
Diaeretiella rapae
- Metopolophium dirhodum***
Aphidius sp.
Monoctonus sp.
- Monelliopsis caryae***
Trioxys pallidus
- Myzocallis* sp.**
Trioxys pallidus
- Myzus ascalonicus***
Lysiphlebus testaceipes
- Myzus cerasi***
Praon sp.
- Myzus persicae***
Diaeretiella rapae

Myzus sp.

Aphidius sp.
Diaeretiella rapae
Praon sp.

Nearctaphis clydesmithi

Lysiphlebus testaceipes

Oestlundia flava

Trioxys sp.

Panaphis juglandis

Trioxys pallidus

Periphyllus lyropictus

Euaphidius setiger

Periphyllus sp.

Adialytus salicaphis

Phorodon humuli

Aphidius matricariae
Binodoxys conei
Diaeretiella rapae
Lysiphlebus testaceipes

Plectrichophorus sp.

Trioxys sp.

Pterocomma bicolor

Euaphidius cingulatus

Pterocomma sp.

Euaphidius cingulatus

Rhopalosiphum maidis

Diaeretiella rapae
Lysiphlebus testaceipes
Praon unicum

Rhopalosiphum padi

Aphidius ervi
Diaeretiella rapae
Lysiphlebus testaceipes
Monoctonus washingtonensis
Praon occidentale
Praon unicum
Praon yakimanum

Sipha elegans

Adialytus ambiguus

Sipha sp.

Adialytus ambiguus

Sitobion avenae

Aphidius avenaphis
Aphidius ervi
Aphidius sp.
Diaeretiella rapae
Lysiphlebus testaceipes

Therioaphis trifolii

Praon exsoletum

Uroleucon cirsii

Lysiphlebus testaceipes

Uroleucon ivae

Aphidius ohioensis
Aphidius sp.
Praon pequodorum
Praon sp.

Uroleucon russellae

Ephedrus californicus
Praon sp.

Uroleucon sp.

Aphidius ohioensis
Ephedrus californicus
Ephedrus sp.
Praon occidentale

Utamphorophora humboldti

Aphidius sp.

Mixed aphid colonies:**Acyrtosiphon lactucae/Macrosiphum euphorbiae**

Praon sp.

Aphis helianthi/A. nr. varians/A. sp.

Binodoxys grafi

Hyperomyzus lactucae/Macrosiphum euphorbiae

Praon sp.

Hyperomyzus lactucae/Uroleucon sonchi

Aphidius sp.

Illinoia rhododendri/undetermined sp.

Ephedrus sp., *Praon* sp.

Obtusa cauda coweni/Zyaxaphis oregonensis

Binodoxys clydesmithi

Sitobion clydesmithi/Sitobion sp.

Praon sp.

DISCUSSION

The above results constitute a beginning faunistic baseline. Of the total aphidiines discovered, at least five (*Aphidius colemani*, *Aphidius ervi*, *Praon exsoletum*, *Trioxys cirsii*, and *Trioxys pallidus*) represent purposely or accidentally introduced species or species not originally part of the Nearctic fauna. *Trioxys cirsii*, a European species, was recorded for the first time in North America. Secondary adaptation or adaptation of the indigenous parasitoids to new or introduced aphids was common. For example, *Diuraphis noxia*, first detected in

1987 in Washington (Pike et al. 1991), was attacked by more than a half a dozen indigenous species.

The number of aphid-parasitoid genera and species now recognized in the Pacific Northwest is much higher than previously known (Marsh 1979). Ten new species have been described from Washington since 1994 (see also Pike and Starý 1995a, 1995b, 1996). The cumulative parasitoid-aphid-plant information, obtained from varied environments, in part, illustrates the biological characteristics and interlinkage associations of the species, and provides a basis for further studies into biosystematics, species succession, host regulation and biological pest control. These data on parasitoid \times host and host-habitat relationships expand not only the knowledge base on population structure, but also help to define the movement and activity of the parasitoids within and between crops and non-crop environments.

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